

## EXPLANATION OF THE PLATES.

## PLATE XXXIII.

## Development of Agrionid Dragonflies.

- Fig. 1. The egg of *Ischnura elegans* Lind., some hours before hatching.  
 Fig. 2. Part of the same egg, at a later stage, showing the shell-rupture and the vesicle formed, and the head just commencing to move forward.  
 Fig. 3. Part of the egg, at a still later stage, showing the head  $\times$  almost filling the vesicle. *a* is the point at which the membrane will rupture for the escape of the pronymph.  
 Fig. 4. The pronymph immediately after its escape from the egg.  
 Fig. 5. Prothorax, dorsal view, of the imago of *Agrion puella* L., ♀.  
 Fig. 6. Prothorax, dorsal view, of the imago of *Agrion pulchellum* Lind., ♀.

## PLATE XXXIV.

## Development of Agrionid Dragonflies.

- Figs. 1, 2, 3 show the last stages of wing-development in the nymph of *Ischnura elegans* Lind., in this case stages 10, 11, and 12. The drawings are from the moulted skin.  
 Fig. 4. The "mask" of *Agrion pulchellum* Lind., in the first stage, upper side.  
 Fig. 5. One of the labial palpi of the same "mask"  $\times$  about 400.  
 Fig. 6. The "mask" in the third stage.  
 Fig. 7. The "mask" in the seventh stage, showing the palpi almost closed down on the anterior border of the labium. The stiff hairs are so situated that when the nymph is feeding they assist in holding the food, the mouth being situated just above *b*.

#### 4. Growth-Stages in the British Species of the Coral Genus *Parasmilia*. By W. D. LANG, M.A., F.Z.S., British Museum (Nat. Hist.).

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(Text-figs. 38-46.)

#### I. CARRUTHERS' "PHASES" IN CARBONIFEROUS CORALS.

In the early numbers of last year's 'Geological Magazine' an article by R. G. Carruthers appeared on some simple Carboniferous Corals\*. In it stress is laid on the necessity of cutting serial sections of corals and for the determination of species according to their growth-stages. It is shown that Carboniferous corals previously described as various species of *Zaphrentis* are really different forms of *Caninia cornucopie* Michelin, and that during development five "phases" can be recognised, occurring in the following order: (1) that corresponding with *Zaphrentis vermicularis* de Koninck; (2) with *Lophophyllum dumonti* Edwards & Haime; (3) with *Zaphrentis nystiania* de Koninck; (4) with *Zaphrentis edwardsiana* de Koninck; (5) with *Caninia cornu-boris* Michelin.

It is important that the term "phase" is used to designate these forms and not the implicative "stage," and the reason is

\* R. G. Carruthers, 1908, Geol. Mag. pp. 20, 63, & 158.

given:—"Save for the appearance of the dissepimental ring (a feature confined to the mature part of the corallum) none of the phases above described is truly ontogenetic, for, as will now be explained, they are intimately connected with the habits of growth of the corallum." This is only an expression of the common difficulty in the determination of species of any group, especially among fossils, the environment of which when alive is so uncertainly understood—that of knowing whether a given character is directly the result of heredity or caused by environment,

These "habits of growth" are shown to be the external shapes of the corallum at a given size, two shapes being mentioned, Trochoid and Cylindrical. And it is obvious from the examination of simple corals that a Trochoid or a Cylindrical shape-stage is always present, and if both, the former always precedes the latter. For simple corals, then, two definite shape-stages may be postulated; nor can the environment directly reverse the order in which they occur. Other growth-stages in the shape of the corallum may be found in simple corals; for instance, an Inverse-trochoid shape-stage occurs in some *Montlivaltia* following the Cylindrical shape-stage, and a Discoid shape-stage in other *Montlivaltia* as an episode in the Trochoid; but these need not here be considered.

So far as *Caninia cornucopie* is concerned, it appears that the environment determines the size reached by the corallum before it passes from the Trochoid to the Cylindrical shape-stage. If this were all, Carruthers' "phases" in *C. cornucopie* might be adopted unhesitatingly as "truly ontogenetic" growth-stages, and the determination of the species only complicated by the wide limits of variation of the diameter, so that a comparatively large specimen might be found in an early growth-stage, and *vice versa*. But it is stated that "it often happens that examples showing the long septa of the *dumonti*-phase are found to have the amplexoid septa," characteristic of the next—the *nystiana*-stage—"in their lower portions." This appearance of an older stage, earlier than, that is proximal to, a younger one, might seem to deny that the "phases" are growth-stages. The sequence in which the "phases" occur, however, is nowhere stated to be irregular, that is, haphazard and different in different individuals; on the contrary, except for the above modification, it is implied that the order of phases is in regular sequence. An explanation of the apparent irregularity is suggested by the behaviour of the costæ in the English species of Chalk *Parasmilia*, which alter in their ornamentation and general shape in a definite way when traced from the proximal to the distal end of the corallum.

Before describing these it may be said that Carruthers mentions other difficulties in the way of accepting his "phases" as true ontogenetic growth-forms. It appears that some internal characters change in correspondence with the change in general shape, others with change in the actual size of the corallum. Consequently, in extreme cases of non-correspondence between the size and shape

of the corallum, some internal characters at a given time will not be at the stage of development corresponding with the expected synchronous stage of the other internal characters. How far this is the case and how far it may be explained in the same way as the irregularity in the sequence of the costal ornamentation in *Parasmilia*, further work will show.

## II. GROWTH-STAGES IN CHALK *PARASMILIA*.

The English species of Chalk *Parasmilia* are attached by their proximal ends to foreign objects. That this is an environmental rather than an hereditary character seems probable from the freedom and varying degrees of fixation in *Montlivaltia*, presumably of one species and from the same horizon and locality; for example, in *M. rugosa* Duncan \*, from the *armatus*-zone of the Lias of Honeybourne, E. of Evesham, Worcestershire. It is conceivable that on a muddy sea-bottom a simple coral would find support in the mud around it, sufficient to hold it upright, while on a hard bottom it would have need to be fixed. The environment of the Chalk sea evidently required the *Parasmilia* to be attached to some hard object. Owing to their fixation, the proximal end spreads out to form a surface of attachment. So there is in *Parasmilia*, first a Peduncle shape-stage, next a Trochoid, and ultimately, in most, a Cylindrical shape-stage.

The English species of *Parasmilia* which have been up till now described fall readily into two divisions (see Table, p. 307), according to the nature of the costæ at the proximal end of the corallum. In one division the proximal end is smooth, that is the costæ on it are smooth and inconspicuous, or even hardly discernible, and only come into evidence in the Trochoid shape-stage; in no stage do they appear granular. In the second division the Peduncle or lowest Trochoid shape-stage is granular; the granules may appear dispersed irregularly or may fall into definite lines and tend to form irregular ridges, and in all cases they have become the costal ornament by the time the Trochoid shape-stage is reached. The first division contains the species *P. centralis* (Mantell) and *P. serpentina* Edwards & Haime. The described English species of the second division are *P. fittoni* Edwards & Haime, *P. granulata* Duncan, *P. gravesi* Edwards & Haime (Duncan's interpretation), *P. mantelli* Edwards & Haime, *P. cylindrica* Edwards & Haime, and *P. monilis* Duncan (as here interpreted). At first sight it is difficult to see any connection between the costæ of the first and those of the second division. But a detailed examination of the ontogenetic development of the costæ renders it likely that the primitive costal stages of the second division represent the adult costal stages of the first division. At any rate, non-granular stages precede the granular in the second

\* P. M. Duncan, 1868, "British Fossil Corals," Mon. Pal. Soc. p. 58, pl. xvi. figs. 5-15. Compare, for instance, fig. 6 (B.M. no. R. 12043) with fig. 14 (B.M. no. R. 12051).

division. In each species the costæ, in passing from the proximal to the distal end of the corallum, exhibit very definite growth-stages; and these costal stages are dependent on changes in two characters—the general shape of the costa and its ornamentation.

The changes in the general shape of the costa are from a broad, low, indistinct, to a comparatively narrow, high, and clearly marked costa, and a corresponding katagenetic phase. The katagenesis\* is nearly always rapid compared with the anagenesis\*, and each is represented on the diagram, text-fig. 38, by a steep limb of the wave-like progression. It appears that thrice over in the series under consideration has this period of costal rise and fall been repeated, and each time with a different type of ornamentation.

When present, the ornamentation of the costa is of two kinds. In the most primitive stages the costæ are plain, or *very* slightly rough, and only change in height. This period is therefore here called the Plain Period (text-fig. 38). The first marked ornamentation is a longitudinal etching as if the costal surface had been corroded. As this becomes more intense, the ridges tend to mass together and fuse, until the highest development is a wavy ridge down the middle of the costa. Correlated with this etched ornamentation is a second period of costal rise, the broader lower costa having the irregular etching, and the high narrow costa the ridged ornament; this is the Etched Period. The second and more advanced type of ornament is the granule, and the Granular Period corresponds with a third costal rise.

Nine main stages may thus be formulated in this series of Corals, namely, a low, medium, and high stage in the Plain, Etched, and Granular Periods. Katagenetic stages have not been considered, because as a rule they are passed through too quickly to be appreciated. Of course, no one species of *Parasmilia* shows all nine stages; in fact the first three are so condensed in *P. centralis* (Mantell), one of the more primitive species, that a Plain Period would not have been suspected to have had a separate existence from the Etched Period, had not the scheme suggested it when the other stages were marshalled in order. A more careful examination of *P. centralis* (Mantell) then showed a heightening of the costa (costal-stage III.) before the normal low etched stage (costal-stage IV.), thus revealing a Plain Period, characteristic of *P. serpentina* Edwards & Haime, preceding the characteristic Etched Period of *P. centralis* (see text-fig. 40, F, G, p. 295). Such Tachygenesis† is, however, to be looked for when cases of individual development in other phyla are remembered. Again, the greatest gap in the series is between *P. centralis* (Mantell), the most advanced costal-stage of which is the high stage of the Etched Period (costal-stage VI.), and *P. fittoni* Edwards & Haime, the greater extent of whose costæ is in the low normal stage

\* A. Hyatt, 1889, "Genesis of the Arietidæ," Smithsonian Contributions to Knowledge, Washington, xxvi. Art. 2, pp. 71-74.

† A. Hyatt, 1893, "Bioplastology and the related branches of Biologic research," Proc. Boston Soc. Nat. Hist., vol. xxvi. p. 77.

of the Granular Period (costal-stage VII.). To detect and interpret the stages of the earlier parts of *P. fittoni* before costal-stage VII.

Text-fig. 38.

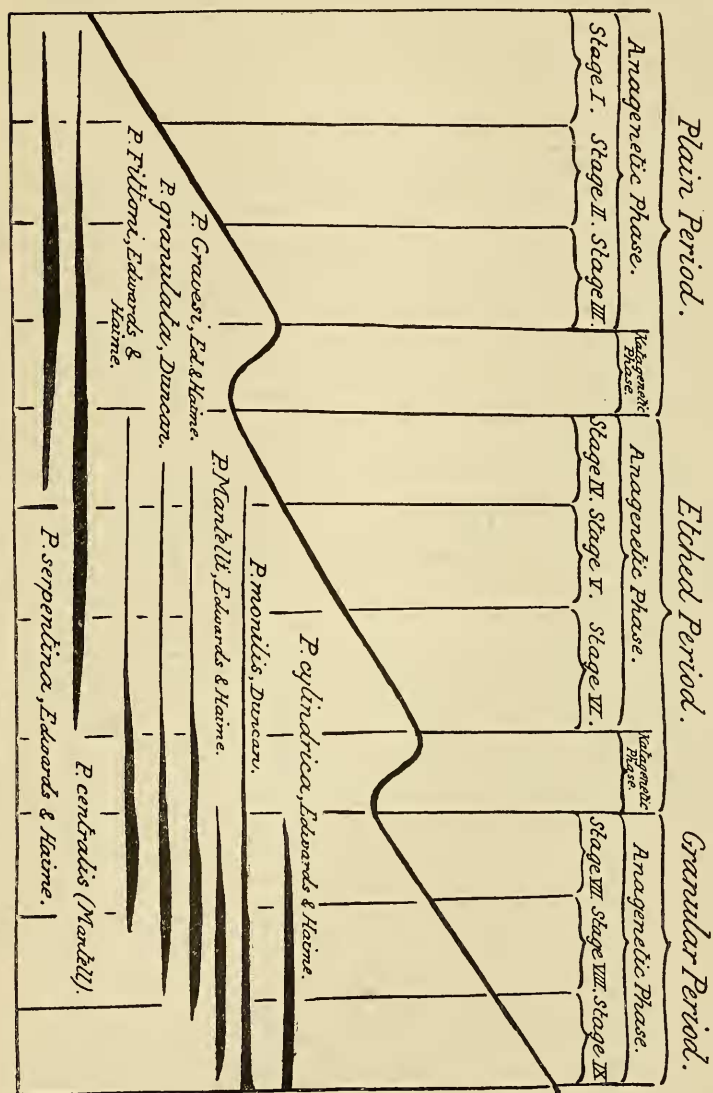


Diagram illustrating the progress of costal ornamentation in the English species of *Parasmittia*.

requires close observation. From this it will be realised how diagrammatically the case has been stated. But unless it is first

presented in its baldest and most diagrammatic aspect, the extraordinary regularity in the genetic sequence of the costal character may be lost sight of in the greater or less amount of development and condensation of the various characters, and in certain irregularities in their actual sequence due to environmental and other causes. One such case will be next considered.

### III. RECAPITULATION OF GROWTH-STAGES AT REJUVENESCENCE.

The life-history of the costa in an actual specimen of each of the described forms of English Chalk *Parasmilia* will be given later on, that of the type-specimen when available, and in the cases where this is not in the British Museum, one of Duncan's figured specimens if possible. In two cases specimens are described which have no historical value in point of view of identification. But before describing these actual cases, an important modification in the regular sequence of growth-stages must be noted. Periodically in the growth of the corallum constrictions arise, marking points in the life of the coral when fresh growth took place after a period of rest. Such revivals of growth are known as Rejuvenescence\*, a term very happily introduced, because the coral literally renews its youth at these points, and expresses the renewal by recapitulating earlier growth-stages in a condensed form; at least this is so in the costal characters of *Parasmilia*†. A glance at the actual costal life-histories given hereafter (see text-figs. 39-46) will show the extent of this recapitulation.

There is no reason for supposing that the recapitulation of younger stages at rejuvenescence is confined to the two characters observed, nor only to the genus in question; rather, it probably extends to the internal structure and is of general application. The anomaly then in *Caninia cornucopie* Michelin, described by Carruthers and mentioned early in this paper, may be explicable by this phenomenon. The coral had developed as far as the *nystiana*-stage, had next entered a period of rest, and on rejuvenescence, with renewed growth, had begun in the *dumonti*-stage, recapitulating its growth from that stage to the *nystiana*-stage again, and then proceeding, perhaps through further interruptions of rejuvenescence and consequent recapitulations, to the *edwardsiana*-stage.

### IV. BERNARD'S THEORY OF THE NATURE OF REJUVENESCENCE.

It is difficult to dissociate rejuvenescence from branching when viewed in connection with recapitulation of earlier stages. Robert

\* "Verjüngung-process," Milashevitch, 1876, Palæontographica, vol. xxi. p. 194-5. "Rejuvenescence," Tomes, 1882, Quart. Journ. Geol. Soc., p. 409; 1884, *op. cit.* p. 363; 1886, Geol. Mag., p. 394; 1888, *op. cit.* p. 208; 1899, *op. cit.* p. 305.

† It is the phenomenon here described that Bernard refers to in a footnote, British Museum Catalogue of Madreporarian Corals, 1906, vol. vi. p. 22.

Tracey Jackson \* has shown how generally this takes place among plants and is exhibited by the leaves. In many plants these show progressive development when traced from the proximal to the distal end of the branch, and the stage at the proximal end is an earlier one than that of the leaf subtending that branch. A similar case has been suggested among Polyzoa, concerning the change in general shape of the zoæcium †. Reduced to its simplest expression, branching in corals is seen to become simple fission in the vertical plane, exhibited by such a form as *Thecosmilia* [*Chorisastræa*] *rugosa* (Tomes) non Laube ‡, which is only a *Montlivaltia* which has taken to division by fission; the *Montlivaltia*-stage of this coral is very near *M. painswicki* Duncan §, which comes from the same horizon and district—the Aalenian of the Cotteswolds. Another case is the specimen figured by Duncan as *Thecosmilia obtusa* || (d'Orbigny), which is only a *Montlivaltia fairfordensis* ¶ Tomes, which has begun to divide by fission: both come from the Bathonian clay of Fairford, Gloucestershire, and these forms as well as fully divided ones are common enough among the material from there. The examples quoted are exhibited in the British Museum, where all the specimens mentioned in this paper, unless otherwise stated, are to be seen. In some Cœlenterates fission normally occurs in the horizontal plane, resulting in the well-known phenomenon of strobilization. It is obvious that if horizontal fission were to occur in a coral, the upper product would obliterate the lower, since, having no means of locomotion, it would continue to grow in place and would secrete its skeleton on the top of the old \*\*. That this new skeleton would be in strict continuity with the old is rendered likely by the soft nature of the secretory surface, which by its own weight would be moulded on the underlying old skeleton, and, when secreted, the new skeleton would reproduce the shape of, and so fit, the old. An interesting case showing this is afforded by a specimen exhibited in the British Museum (No. R. 9148) of the *Montlivaltia*-stage (*M. fairfordensis* Tomes) of *Thecosmilia obtusa* (d'Orbigny), growing on an oyster with a ribbed shell. The ribs of the oyster-shell are continuous with the costæ of the coral which has settled on it.

\* R. T. Jackson, 1899, "Localised Stages in Development," Mem. Boston Soc. Nat. Hist. vol. v. no. 4, pp. 92, 131.

† W. D. Lang, 1905, Geol. Mag. pp. 259, 260.

‡ R. F. Tomes, 1882, Quart. Journ. Geol. Soc. p. 428; B.M. no. R. 10847.

§ P. M. Duncan, 1872, Mon. Pal. Soc., Part iii. p. 17, pl. i. fig. 12; B.M. no. R. 2305.

|| P. M. Duncan, 1872, Mon. Pal. Soc., Part iii. p. 14, pl. i. figs. 1-4; B.M. no. R. 8455.

¶ R. F. Tomes, 1883, Quart. Journ. Geol. Soc. pp. 181, 182, pl. vii. fig. 21; B.M. no. R. 8469.

\*\* H. M. Bernard, 1906, British Museum Catalogue of Madreporarian Corals, vol. vi. p. 22.

## V. REJUVENESCENCE AND TABULA-FORMATION.

Bernard\*, who put forward this explanation of Rejuvenescence, goes further and suggests that tabula-formation has a similar origin. This is in direct contradiction to the generally accepted idea that tabula-formation is only a more complete form of dissepiment-formation; that whereas the latter only expresses a frequent and partial recession of the soft parts from the lower portion of the skeleton as the coral grew upwards, so tabulae express a periodic upward retreat of the soft parts as a whole. This may well be the origin of tabulae (dissepimental tabulae) in post-Rugose Madreporaria, the apparent tabulae of which in many cases seem to be modified dissepiments and often are seen to accompany the reduction of septa. This is so in a series of Bathonian species placed in various genera, but all allied to *Cyathophora* and *Cryptocenia*, of which a series is exhibited in the British Museum. These show the tendency to lose their septa and convert the interseptal dissepiments into tabulae. Intermediate forms occur between *Cyathophora pratti* Edwards & Haime, with well developed septa and few large dissepiments which tend to correspond with similar ones on the other side of the corallite, and *Astraea bourgeti* DeFrance, in which the septa are only ridges and there are clearly marked tabulae. *Holocystis elegans* (Fitton), from the Lower Greensand, has tabulae and reduced septa, and the same is true of the Palaeozoic Tabulate corals. That tabula-formation of this origin may have followed and replaced their formation from a transverse fission is possible; but the two methods are essentially distinct and mutually exclusive. The recapitulation of earlier stages might be used as a test to determine which cause is operative in any case, for there is no reason to suppose that it would occur merely on the upward movement of the coral in its skeleton; while it has been shown to occur as an accompaniment of rejuvenescence.

## VI. ASTOGENY AND HISTOLYSIS.

Before leaving the subject of rejuvenescence connected with fission in a horizontal plane, it is interesting to note that Bernard† claims a similar behaviour in the coral colony to that in the individual. Colonies of corallites, he says (that is, whole corolla), undergo rejuvenescence, forming the well-known masses of coral in cake-shaped pieces piled one on the other (metamerically segmented, Bernard suggests), or else branched in regular order of repetition. And he mentions an observation by Duerden‡ of a living form which suggested that at the periods of rejuvenescence a general histolysis took place in the coral mass, representing collectively the fission of each individual. Again, the Polyzoa afford

\* H. M. Bernard, 1906, *loc. cit.* p. 23.

† H. M. Bernard, 1906, British Museum Catalogue of Madreporarian Corals, vol. vi, top of p. 24.

‡ Duerden, 1904, "The Coral *Siderastraea*," Washington, Carnegie Institution (4*de* Bernard).

a parallel example of the behaviour of the colony as an individual. In these animals the whole zoarium (colony) undergoes growth-stages just as does the individual (zoecium). This was first pointed out in Polyzoa by Cumings\*, and he termed the colonial developmental history Astogeny, as contrasted with the individual Ontogeny.

VII. INDIVIDUAL COSTAL LIFE-HISTORIES OF THE DESCRIBED SPECIES OF ENGLISH *PARASMILIA*. (Text-figs. 39-46).

[Note.—The letters B.M. in the following descriptions mean "British Museum." The stages in the life-history of the individual are lettered thus: A, B, C, . . . &c.; the costal-stages of the whole series: I., II., III., &c.]

1. *PARASMILIA SERPENTINA* Edwards & Haime. (Text-fig. 39.)

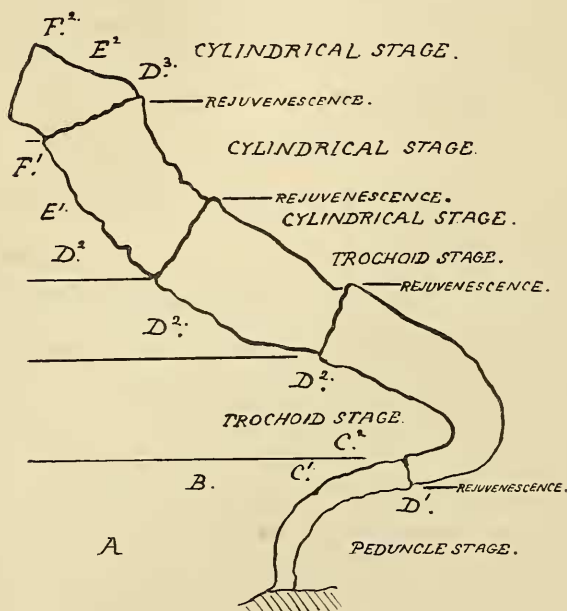
*Parasmilia* (?) *serpentina* Edwards & Haime, 1850, "British Fossil Corals," Mon. Pal. Soc. p. 51, pl. viii. figs. 3, 3 a, 3 b.

Type-specimen, B.M. no. 48414.

Text-fig. 39.

*PARASMILIA SERPENTINA*,

*Edwards & Haime.*



Costal stages in *P. serpentina* Edwards & Haime.  
Type-specimen, B.M. no. 48414.  $\times 2\frac{1}{2}$ .

\* E. R. Cumings, 1904, American Journal of Science, series 4, vol. xvii. p. 49.

In this specimen the Peduncle, Trochoid, and Cylindrical shape-stages are all long and pass gradually from one to another, giving the corallum a regularly tapering shape. A rejuvenescence very early in life makes a convenient demarcation between the Peduncle and Trochoid shape-stage. The Peduncle being smooth for the first quarter of its course, there is a Precostal stage (text-fig. 39, A). Low plain costæ (text-fig. 39, B, costal-stage I.) succeed, and reach nearly to the first rejuvenescence; but just before this the costæ become higher (text-fig. 39, C<sup>1</sup>, costal-stage II.), and are almost ridged (text-fig. 39, D<sup>1</sup>, costal-stage III.) when rejuvenescence occurs. On resumption of growth the costæ are in costal-stage II. (text-fig. 39, C<sup>2</sup>), but rapidly pass again to costal-stage III. (text-fig. 39, D<sup>2</sup>), which is the characteristic stage of the corallum as a whole, and continues to the distal side of the third rejuvenescence; that is, at the second and third rejuvenescences the recapitulation is so slight that costal-stage II. is not repeated. At about halfway between the third and fourth rejuvenescences there is a sharp katagenesis (text-fig. 39, E), marked by a lowering of the costa and the disappearance of the ridge. The costæ then take on an etched ornamentation (text-fig. 39, F<sup>1</sup>, costal-stage IV.), but are thrown back again to costal-stage III. (text-fig. 39, D<sup>3</sup>) after the fourth rejuvenescence. The katagenesis and advance to costal-stage IV. is again repeated (text-fig. 39, E<sup>2</sup>, F<sup>2</sup>), and then the corallum terminates. The Trochoid shape-stage passes insensibly into the Cylindrical between rejuvenescences two and three.

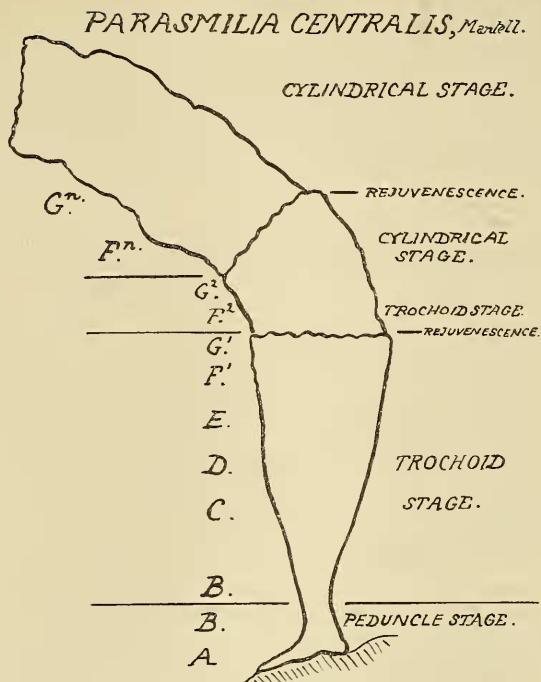
## 2. PARASMILIA CENTRALIS (Mantell). (Text-fig. 40.)

*Madrepora centralis* Mantell, 1822, "Fossils of the South Downs," pp. 159-160, pl. xvi. fig. 4.

Type-specimen, B.M. no. 5462.

On the expanded base of the type-specimen there is no appearance of costæ (text-fig. 40, A). This Precostal stage is followed by very faint, low, plain costæ on the Peduncle and lowest Trochoid shape-stages (text-fig. 40, B, costal-stage I.). By the mid-Trochoid shape-stage the costæ, though still plain (or *very* faintly roughened), have become more prominent and higher (text-fig. 40, C, D, costal-stages II. & III.). They then undergo a rapid katagenesis and appear low again, but this time markedly etched (text-fig. 40, E, costal-stage IV.). Shortly before the first rejuvenescence the costæ are heightened (text-fig. 40, F<sup>1</sup>, costal-stage V.) and become ridged (text-fig. 40, G<sup>1</sup>, costal-stage VI.). Between the first and second rejuvenescences the shape passes from Trochoid to Cylindrical, and costal-stages V. and VI. are repeated (text-fig. 40, F<sup>2</sup>, G<sup>2</sup>); and though there is no definite rejuvenescence after the second, alternations of costal-stages V. and VI. occur (text-fig. 40, F<sup>n</sup>, G<sup>n</sup>) and show periods of growth alternating with fleeting rest-periods.

Text-fig. 40.



Costal stages in *P. centralis* Mantell.  
Type-specimen, B.M. no. 5462.  $\times 2$ .

### 3. *PARASMILIA FITTONI* Edwards & Haime. (Text-fig. 41.)

*Parasmilia fittoni* Edwards & Haime, 1850, "British Fossil Corals," Mon. Pal. Soc. p. 50, pl. ix. fig. 2 (*non* figs. 2 *a*, 2 *b*).

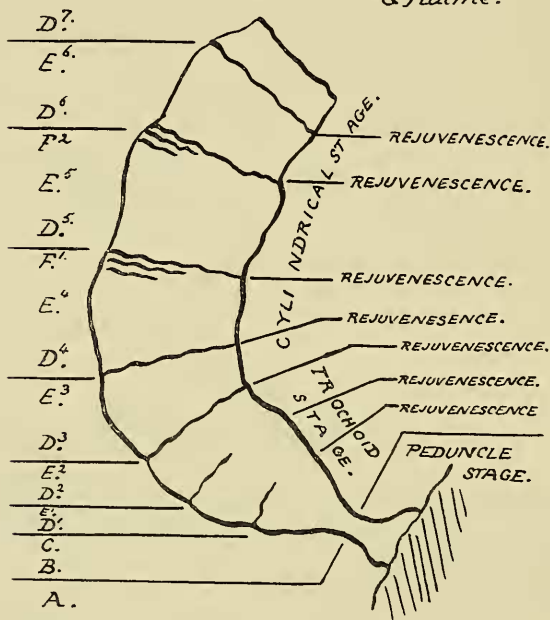
Type-specimen, B.M. no. 48412.

In their Monograph on British Fossil Corals, Edwards & Haime state that *Parasmilia fittoni* is in the collections of the Geological Society, of the Geological Survey, and of the Museum at Paris. This species is not mentioned in Blake's and Sherborn's list of types in the collection of the Geological Society; nor do the Geological Survey possess the types; while at Paris there is the specimen figured on pl. ix. figs. 2 *a*, 2 *b*, but not fig. 2. The British Museum specimen No. 48412 agrees with Edwards & Haime's description and exactly corresponds with fig. 2 (reversed in printing so that the figure is a mirror-reflection of the specimen) and evidently is one of Edwards & Haime's two types. It follows then that there are two syntypes of this species, B.M. no. 48412, pl. ix. fig. 2 of Edwards & Haime, and the Paris specimen figured on pl. ix. figs. 2 *a*, 2 *b*; nor is it certain without examination of

the Paris example that the two specimens are specifically identical. To save further confusion the specimen at hand, B.M. no. 48412, is considered here as the holotype of *P. fittoni*; and the specific determination of the Paris specimen must be settled when an opportunity of examining it occurs. I wish to express my thanks to Dr. Kitchin, of the Museum of Practical Geology, and to Professor Boule, of the Muséum d'Histoire Naturelle, Paris, for their kindness in supplying me with information in this matter.

Text-fig. 41.

*PARASMILIA FITTONI*, Edwards  
& Haime.



Costal stages in *P. fittoni* Edwards & Haime.  
Type-specimen, B.M. no. 48412.  $\times 1\frac{1}{2}$  (Peduncle restored.)

In the forms hitherto considered, the costal growth-stages have been easy to follow, because the ornamentation of the costa has regularly followed the changes in its general shape. Six stages have been demonstrated covering two periods—the Plain and Etched Periods; so that the stages have been termed Low Plain, Medium Plain, High Plain, Low Etched, Medium Etched, and High Etched. With *P. fittoni* a new type of ornamentation is introduced—the granular ornament, and with it a new period of costal elevation. But so dominant is the granular ornamentation in *P. fittoni*, that instead of first appearing with a low wide costa,

it comes in while the costæ are still high after costal-stage VI. (the High Etched) and katagenetic as far as height goes from costal-stage VI. towards the low costa of costal-stage VII. So far the katagenetic phases of each period have been inconsiderable, but the fall in height from costal-stage VI. to costal-stage VII. occupies much of the Trochoid shape-stage in the type of *P. fittoni*. In this specimen the peduncle is absent and the costæ on first appearing are in costal-stage VI., the High Etched stage. The earlier stages are seen in the B.M. specimen No. R. 6632, figured as *Monocarya centralis* Mantell by Lonsdale, 1850, in Dixon's 'Geology of Sussex,' pl. xviii. fig. 4. This specimen, unfortunately damaged in the Trochoid shape-stage, exhibits the earlier and later parts and agrees very closely with the type specimen of *P. fittoni*. The costæ when first visible are low and wide, but rapidly become narrow and high with an ornamentation consisting of massed granules (text-fig. 41, A, costal-stages IV.-V.-VI.). As far as this first high stage the ornamentation appears as merely a roughness and is considered as indicating the Etched Period. The Peduncle shape-stage may be looked upon as including the Plain and Etched Periods of costal development reduced by Tachygenesis to a mere rise in the costa accompanied by a roughening of the surface. Whether this is the true explanation or not, it is a fact that there is a period of costal elevation which has declined before the appearance of the typical granular ornament of *P. fittoni*.

On returning to the type-specimen B.M. no. 48412, it is found that the peduncle is broken off, so that the corallum begins in the lowest Trochoid shape-stage. The costæ when first clearly seen are high and narrow (text-fig. 41, B), but rapidly widen and become lower (C) until, by the middle of the Trochoid shape-stage, they are wide and low and by this time have assumed the typical ornamentation of the species, which is very small granules, individually separate (text-fig. 41, D', costal stage VII.). At first, with the high costæ, the ornament appears as a rough ridge, which, as the costa widens, becomes lower, resolves into massed granules and finally (costal-stage VII.) into granules individually separate. This katagenesis suggests a previous granular anagenesis, but the stages on the peduncle do not suggest this; they are etched rather than granular, and it is more probable that the granules of costal-stage VII. have appeared earlier than their appropriately shaped costa and have become massed and piled in consequence of the shape of the costa.

At about the mid-Trochoid shape-stage, before the costæ have reached costal-stage VII., the first rejuvenescence occurs. It does not, however, interrupt the progress of the costal stages by causing recapitulation. This and the next rejuvenescence are partial and only affect the convex side of the corallum, which, as a whole, is considerably bent.

Before the second (partial) rejuvenescence, the costæ become narrower and the granules begin to mass together (text-fig. 41, E',

costal-stage VIII.). On resumption of growth costal-stage VII. reappears (text-fig. 41, D<sup>2</sup>) succeeded by costal-stage VIII. before the third rejuvenescence (text-fig. 41, E<sup>2</sup>). This sequence is repeated before the fourth and fifth rejuvenescences (text-fig. 41, D<sup>3</sup>, D<sup>4</sup>-E<sup>1</sup>, E<sup>1</sup>). The fifth and sixth rejuvenescences are compound ones, several occurring in both cases in quick succession. In both, too, the costæ reach a more elevated condition and the massed granules tend to form a ridge before rejuvenescence occurs (text-fig. 41, F<sup>1</sup>, F<sup>2</sup>). This stage is not advanced enough to be considered costal-stage IX., and does not recur in the corallum of this specimen though there is a seventh rejuvenescence. The fifth, sixth, and seventh rejuvenescences throw the costæ back to costal-stage VII

4. *PARASMILIA GRANULATA* Duncan. (Text-fig. 42.)

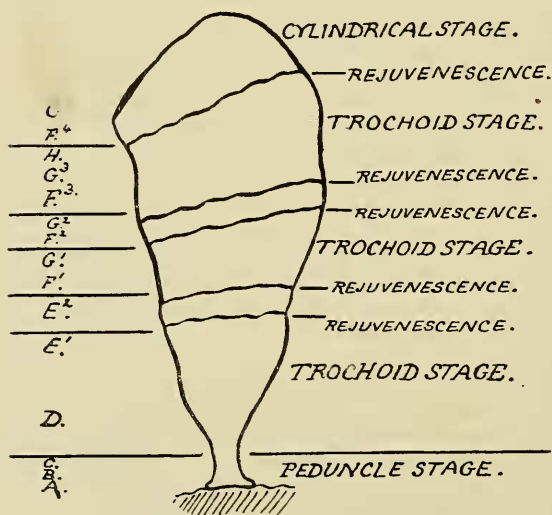
*Parasmilia granulata* Duncan, 1869, "British Fossil Corals," Mon. Pal. Soc. p. 13, pl. vi. fig. 5.

*Monocarya centralis* Lonsdale, 1850, in Dixon's 'Geology of Sussex,' pl. xviii. fig. 2.

Text-fig. 42.

*PARASMILIA*

*GRANULATA*, DUNCAN.



Costal stages in *P. granulata* Duncan.  
Type-specimen, B.M. no. R. 6612.  $\times 2$ .

Type-specimen, B.M. no. R. 6612. (The specimen figured in both the Plates referred to above.)

*P. granulata* very closely resembles *P. fittoni* Edwards & Haime, but costal-stage VII., the typical costal-stage of *P. fittoni*, is very reduced and replaced in importance by costal-stage VIII.; also costal-stage IX. is more nearly attained in *P. granulata*; otherwise the costal-stages closely correspond. But the katagenesis in the height of costa from costal-stage VI. to costal-stage VII. is even more prolonged than in *P. fittoni*, and the first appearance of granular ornament pushed back to costal-stage VI. The individual stages in *P. granulata* (text-fig. 42, A, B, C . . . &c.) will be described in order, so that the points above mentioned may be made clear.

A=Costal-stage IV. The Primary costæ are double, or longitudinally split. Costæ low; ornament etched.

B=Costal-stage V. Similar to stage A, but costæ of medium height.

C=Costal-stage VI. Primary costæ single and so for the remaining stages. Costæ high, narrow; massed granular ornamentation.

D=Costal-stage VII. for the ornament which is of individually separate granules, though not so separate as in *P. fittoni*; and katagenetic for the height of costa from costal-stage VI. to costal-stage VII.

E<sup>1</sup>=Costal-stage VIII. for the ornament which is of massed granules, and katagenetic for the height of costa from costal-stage VI. to costal-stage VII.

First Rejuvenescence.

E<sup>2</sup>. Similar to E<sup>1</sup>.

Second Rejuvenescence.

F<sup>1</sup>=Costal-stage VII. for both height of costa and ornament, *i. e.* a broad low costa and granules individually separate.

G<sup>1</sup>=Costal-stage VIII. Costæ of medium height and breadth; granules massed together and tending to form a central ridge.

Third Rejuvenescence.

F<sup>2</sup> & G<sup>2</sup>. A repetition of stages F<sup>1</sup> & G<sup>1</sup>.

Fourth Rejuvenescence.

F<sup>3</sup> & G<sup>3</sup>. A repetition of stages F<sup>1</sup> & F<sup>2</sup>, G<sup>1</sup> & G<sup>2</sup>.

H=Stage between costal-stage VIII. and costal-stage IX. Costæ high with thin wavy ridge, but massed granules are still evident.

Fifth Rejuvenescence. Trochoid shape stage ends and Cylindrical shape-stage begins.

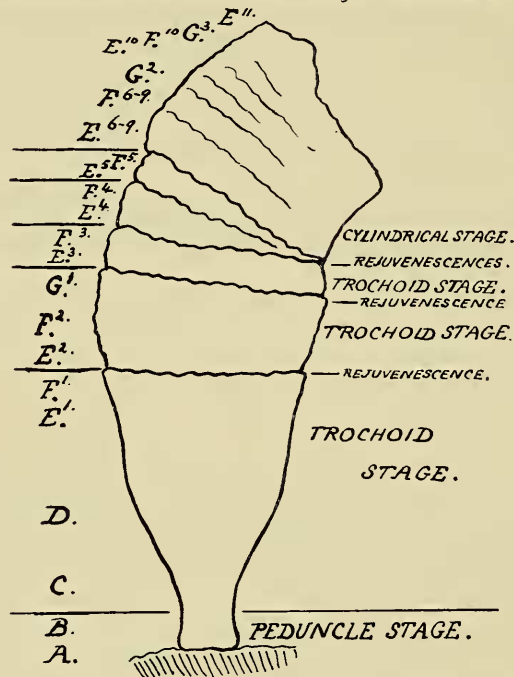
F<sup>4</sup> & G<sup>4</sup>. A repetition of stages F<sup>1</sup> &c., G<sup>1</sup> &c.

5. *PARASMILIA GRAVESI* Edwards & Haime. (Text-fig. 43.)

*Parasmilia centralis* (Mantell), sub-species *gravesana* Edwards & Haime, Duncan, 1869, "British Fossil Corals," Mon. Pal. Soc. p. 12, pl. v. fig. 9.

In the absence of the type-specimen it is necessary to take Duncan's interpretation of this species, and the specimen he figured, B.M. no. R. 6616, is here described as *P. gravesi* Edwards & Haime, on the assumption that Duncan was correct in his determination.

Text-fig. 43.

*PARASMILIA GRAVESI*, Edwards & Haime.

Costal stages in *P. gravesi* Edwards & Haime.  
Duncan's figured specimen, B.M. no. R. 6616.  $\times 2$ .

Specimen No. R. 6616 carries the modifications of *P. fittoni* exhibited in *P. granulata* still further. Costal-stage VII. (when once established for both height and ornament) is hurried through and hardly appears; costal-stage VIII. is important; and costal-stage IX. is actually attained. There is a very prolonged katabolism in the height of the costa from costal-stage VI. to costal-

stage VII.; and the first appearance of granular ornament is pushed back to costal-stage V.

At the extreme edge of the peduncle the costæ are low and have an etched ornament (text-fig. 43, A, costal-stage IV.). On the rest of the peduncle they are higher (text-fig. 43, B, costal-stage V.), but the ornamentation is resolving into granules. On the lowest Trochoid part of the corallum the costæ are high (text-fig. 43, C, costal-stage VI.) and the ornamentation is of individually separate granules and is the ornament of costal-stage VII. pushed backwards. The primary costæ are forked at this stage, the branches crossing neighbouring costæ (*cf.* stages A and B of *P. granulata*). From this point the costæ decrease in height and increase in breadth (text-fig. 43, D, katagenesis from costal-stage VI. to VII.) until past the mid-Trochoid shape-stage; here the costæ are broad and low with individually separate granules (text-fig. 43, E<sup>1</sup>, costal-stage VII.), but immediately these mass and the costa becomes narrower and higher (text-fig. 43, F<sup>1</sup>, costal-stage VIII.), and then rejuvenescence occurs. Between this and the second rejuvenescence costal-stage VIII. (text-fig. 43, F<sup>2</sup>) is dominant, but costal-stage VII. is just represented (text-fig. 43, E<sup>2</sup>) and costal-stage IX. (text-fig. 43, G<sup>1</sup>) is just attained. Rejuvenescences 3, 4, and 5 cause the repetition of costal-stages VII. and VIII. (text-fig. 43, E<sup>3-5</sup>, F<sup>3-5</sup>) but not of costal-stage IX., and costal-stage VII. is only just indicated. The Cylindrical shape-stage has now been reached and a series of very slight constrictions indicates rejuvenescences 6, 7, 8, and 9, with a similar repetition of costal-stages VII. and VIII.; and before rejuvenescence 7 costal-stage IX. is repeated (text-fig. 43, E<sup>6-9</sup>, F<sup>6-9</sup>, G<sup>2</sup>). The repetition of costal-stages VII., VIII., and IX. (text-fig. 43, E<sup>10</sup>, F<sup>10</sup>, G<sup>3</sup>) precedes rejuvenescence 10, which is a large one, and the corallum ends in costal-stage VII. (text-fig. 43, E<sup>11</sup>) which is assumed when growth recommences.

#### 6. PARASMILIA MANTELLI Edwards & Haime. (Text-fig. 44.)

*Parasmilia mantelli* Edwards & Haime, 1850, "British Fossil Corals," Mon. Pal. Soc. p. 49, pl. viii. figs. 2, 2 a.

Type-specimen, B.M. no. 48413.

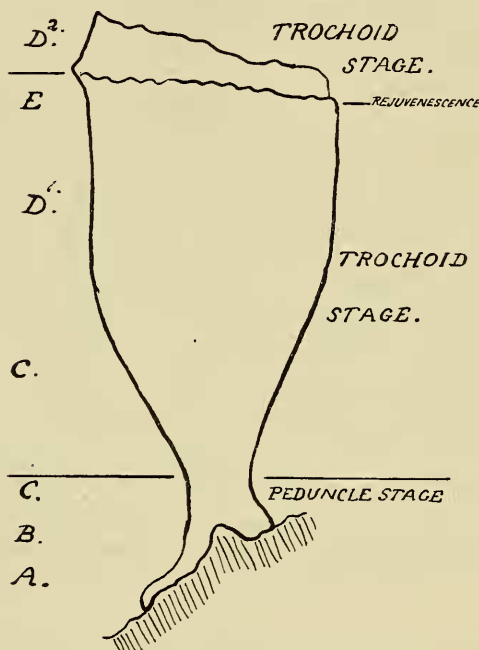
*P. fittoni* Edwards & Haime, *P. granulata* Duncan, and *P. gravesi* Edwards & Haime, form a group of closely allied species, progressing serially in costal development from a condition in which costal-stage VII. is dominant to one in which costal-stage VIII. is more important; and costal-stage IX. is hardly attained. Moreover, in this series there is always a long katagenesis after costal-stage VI. and before costal-stage VII. is attained. The group of *P. mantelli* Edwards & Haime, *P. cylindrica* Edwards & Haime, and *P. monilis* Duncan (as here determined) presents a series progressing from a condition with costal-stage VIII. to one with costal-stage IX. dominant, and though costal-stage VII. may be

represented, it appears, when present, immediately on the peduncle and without any preliminary long katagenesis from costal-stage VI. Also intercostal dissepiments occur on the three species of this group.

Text-fig. 44.

# *PARASMILIA MANTELLI*,

*Edwards & Haime.*



Costal stages in *P. mantelli* Edwards & Haime.  
Type-specimen, B.M. no. 48413.  $\times 3$ .

As soon as costæ appear on the peduncle of *P. mantelli*, they are low and ornamented with few large granules which tend to mass together (text-fig. 44, B, costal-stage VII., A is the pre-costal stage). The costæ then rapidly rise in height, become thinner and the granules become heaped in masses (text-fig. 44, C, costal-stage VIII.). At about halfway in the Trochoid shape-stage intercostal dissepiments occur; and from here to nearly the top of the Trochoid shape-stage the granules tend to disappear from the sides of the costæ and to form a ridge along their top (text-fig. 44, D, stage between costal-stages VIII. and IX.). At the top of the Trochoid stage the costæ have become high and thin with a sharp wavy edge, and the granules

have disappeared from their sides (text-fig. 44, E, costal-stage IX.); intercostal dissepiments are still present. Rejuvenescence now occurs and the corallum ends with resumption of growth in costal-stage VIII. (text-fig. 44, D<sup>2</sup>). Probably the Cylindrical shape-stage begins in this specimen after the first rejuvenescence.

7. *PARASMILIA CYLINDRICA* Edwards & Haime. (Text-fig. 45.)

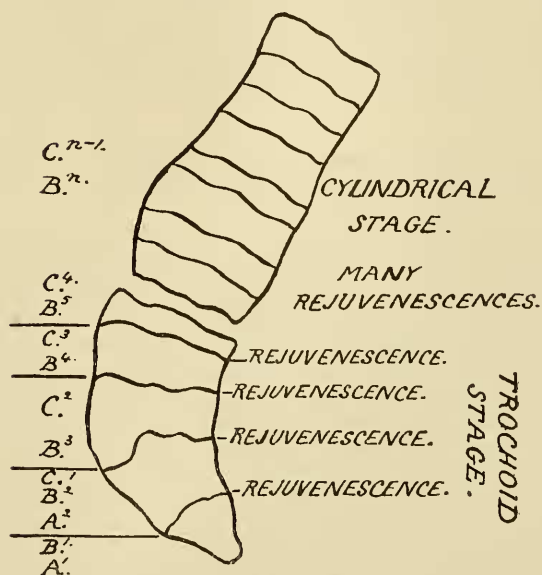
*Parasmilia cylindrica* Edwards & Haime, 1850, "British Fossil Corals," Mon. Pal. Soc. p. 50, pl. viii. fig. 5.

B.M. nos. R. 13889 & R. 6614.

Text-fig. 45.

*PARASMILIA*

*CYLINDRICA*, EDWARDS & HAIME.



Costal stages in *P. cylindrica* Edwards & Haime.  
B.M. nos. R. 13889 & R. 6614.  $\times 1\frac{1}{2}$ .

The type-specimen of this species, from the Norwich Chalk, is stated, by Edwards and Haime, to have been in the "collection of Mr. J. S. Bowerbank." Though the Bowerbank Collection was acquired by the British Museum in 1865, this specimen has not been found. The species, however, is well-marked and easily

distinguished and specimens B.M. nos. R. 13889 and R. 6614, from the Norwich Chalk, are here described. Probably these two are the proximal and distal parts of one corallum; but as they do not exactly fit together, it is not safe to assume that they are one specimen, and the former is chosen as typical of the species, because it shows the early as well as the adult growth-stages.

The costæ are low when they first appear, with few, large granules tending to mass (text-fig. 45 A<sup>1</sup>, costal-stage VII.), but soon become thinner with a crest of massed granules (text-fig. 45, B<sup>1</sup>, costal-stage VIII.). The first rejuvenescence occurs very early in the corallum and throws the costæ back to stage VII. (text-fig. 45, A<sup>2</sup>), whence they rapidly pass to stage VIII. (text-fig. 45, B<sup>2</sup>), and again rapidly to stage IX. (text-fig. 45, C<sup>1</sup>) which is characterised by high, thin, wavy costæ with no granules and with occasional intercostal dissepiments; the latter form an irregular ring round the corallum at the second rejuvenescence, which takes place low down in the Trochoid shape-stage. The costal history need be described in detail no further, as there is henceforth only a frequent alternation of costal-stages VIII. and IX., the latter being predominant and the former tending to disappear altogether in the Cylindrical shape-stage (text-fig. 45, B<sup>n</sup>, C<sup>n-1</sup>).

#### 8. PARASMILIA MONILIS Duncan. (Text-fig. 46.)

*Parasmilia monilis* Duncan, 1869, "British Fossil Corals," Mon. Pal. Soc. p. 12, pl. v. figs. 4, 5, 6.  
B.M. no. R. 6477.

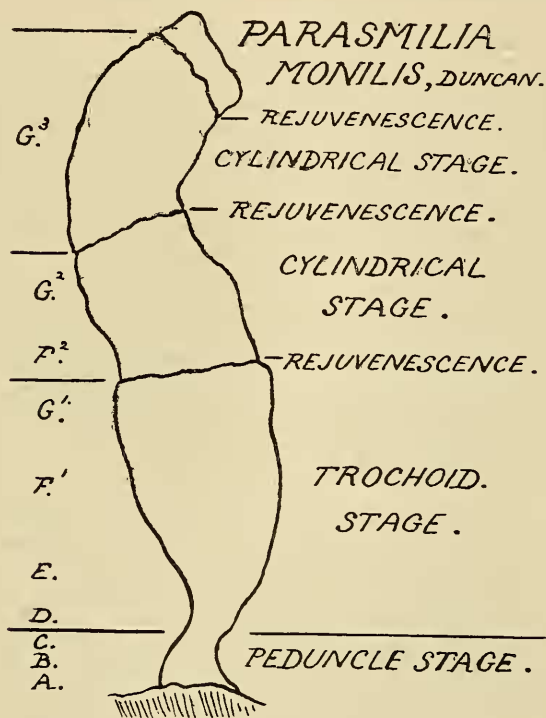
The determination of this species cannot be regarded as settled until the Type-specimen comes to light and has been examined, or its loss certified and a new Type chosen. It is not easy from Duncan's figure to see if intercostal dissepiments are present; they certainly do not appear in enlarged figured pieces of costæ high on the corallum; on the peduncle, of which there is also an enlarged drawing, they would not be expected.

A form represented by the B.M. specimen No. R. 6477 from the zone of *Belemnitella mucronata* Schlotheim, of East Harnham, Salisbury, from the Tomes Collection, is here described as *P. monilis*, as it closely resembles Duncan's figure. Small but numerous intercostal dissepiments are present in the distal part of the corallum, and it is chiefly the presence of these that makes the determination doubtful. Tomes' specimen is one of a series described by him as *P. mantelli* Edwards & Haime. There is also a specimen of *P. monilis* as here defined, B.M. no. R. 6618, figured in 1850 by Lonsdale in Dixon's 'Geology of Sussex,' pl. xviii. fig. 9, as *Monocarya centralis* (Mantell). This, however, has not been chosen for description as the whole of the proximal end is gone, and its exact horizon and locality are unknown.

*P. monilis* as here determined is remarkable for showing an

even more advanced type of adult costa than *P. cylindrica*, in the elimination of costal-stages VII. and VIII. from all but the most proximal part of the corallum; yet on the peduncle more primitive stages are shown than even *P. mantelli* exhibits, and in this *P. monilis* forms a link between *P. gravesi* (as Duncan interpreted it) and *P. mantelli*.

Text-fig. 46.



Costal stages in *P. monilis* Duncan.  
B.M. no. R. 6477.  $\times 3$ .

At the base of the peduncle the costæ are low and rather rough (text-fig. 46, A, costal-stage IV.), but rapidly heighten (text-fig. 46, B & C, costal-stages V. & VI.). In this, the Etched Period, the primary costæ are longitudinally split (cf. *P. granulata* and *P. gravesi*). At the lowest part of the Trochoid shape-stage the costæ are low with few large granules (text-fig. 46, D, costal-stage VII.). These immediately mass together and the costæ rise in height (text-fig. 46, E, costal-stage VIII.) and by the time the mid-Trochoid shape-stage is reached, the granules have entirely vanished, the costæ are high with a thin, somewhat wavy ridge, and intercostal dissepiments have appeared (text-fig. 46, F¹, costal-stage IX.). A

further stage (text-fig. 46, G<sup>1</sup>), in which the costæ are more wavy, occurs before the end of the Trochoid shape-stage. At this point the first rejuvenescence occurs, and on beginning growth again in the Cylindrical shape-stage the corallum is in stage F (text-fig. 46, F<sup>2</sup>), but rapidly passes to stage G (text-fig. 46, G<sup>2</sup>). After the second rejuvenescence the wavy G stage seems to have become permanently established, to the exclusion of stage F.

### VIII. SUMMARY.

Perhaps too much stress has been laid upon what, after all, are only a few observations; but the points introduced are of such interest that it is hoped that they will be borne in mind and tested when work is done on Corals, and not lost sight of in the desire to describe new forms or to prove that too many already have been described. Summarily the points touched on are these:—Hereditary growth-stages exhibited in Rejuvenescence as evidence that the latter is a form of Fission, and subject to the same laws as other forms of Fission, such as Branching; views on the formation of Dissepiments and Tabulæ and Bernard's ideas on these in connection with Fission; their equal application to the colony as to the individual and a suggested relation with Histolysis; finally comparison with other widely different groups of branching organisms—Plants and Polyzoa, that laws of branching in one group may be compared with those in another and any law common to all may be determined.

NOTE:—Owing to the present inaccessibility of the collection of British Chalk fossils formed by Dr. A. Rowe, it has not been possible to test as fully as possible the stratigraphical value of these observations; but thanks to the kindness of Messrs. G. E. Dibley, C. P. Chatwin, and T. H. Withers, a certain amount of zonally-collected material has been available for comparison with the specimens here described. This, together with those of the British Museum specimens whose zone is known, has made it possible to draw up the following scheme of distribution in time. It will be seen that the order of forms arranged according to this distribution agrees on the whole with that deduced above from their structure.

*P. serpentina*, and forms resembling it: zone of *Holaster planus*—  
*Micraster coranguinum*.

*P. centralis*, and forms resembling it: zone of *Holaster planus*—  
*Micraster coranguinum*.

<i>P. fittoni</i> ,	}	and forms resembling them; zone of <i>Micraster coranguinum</i> .
<i>P. granulata</i> ,		
<i>P. gravesi</i> ,		
<i>P. mantelli</i> .		
<i>P. monilis</i> ,	}	Zone of <i>Belemnitella mucronata</i> .
<i>P. cylindrica</i> .		

[3rd April, 1909.]

TABLE CORRELATING INDIVIDUAL GROWTH-STAGES (A, B, C, . . .) WITH COSTAL-STAGES OF THE WHOLE SERIES (I., II., III., . . .).

N.B.—Where letters are not in continuous sequence (e. g. *P. fittoni*, A, D, E) the missing letters represent katagenetic stages.

	Pre-costal-stage.	Costal-stage I.	Costal-stage II.	Costal-stage III.	Costal-stage IV.	Costal-stage V.	Costal-stage VI.	Costal-stage VII.	Costal-stage VIII.	Costal-stage IX.
<i>P. serpentina</i> Edw. & H. . . .	A	B	C	D	F					
<i>P. centralis</i> (Mantell) . . . .	A	B	C	D	E	F	G			
<i>P. fittoni</i> Edw. & H. . . . .	×	×	×	×	A	A	A	D	E	
<i>P. granulata</i> Duncan . . . . .	×	×	×	×	A	B	C	E	G, H	
<i>P. gravesi</i> Edw. & H. . . . .	×	×	×	×	A	B	C	F	F	G
<i>P. mantelli</i> Edw. & H. . . .	A	×	×	×	×	×	×	B	C, D	E
<i>P. cylindrica</i> Edw. & H. . . .	×	×	×	×	×	×	×	A	B	C
<i>P. monilis</i> , Duncan . . . . .	×	×	×	×	A	B	C	D	E	F, G

TABLE FOR DETERMINATION OF ENGLISH SPECIES OF *Parasmilia*.

A. Peduncle and lowest part of Trochoid shape-stage smooth or with faint, plain costæ; no granules; i. e. *costal-stage VII.* is not attained.

- I. Costæ over most of the corallum with sharp plain crest; i. e. *costal-stage III.* is dominant . . . . . 1. *Parasmilia serpentina* Edwards
- II. Costæ over most of the corallum with rough, irregular markings, but not granular; i. e. *Etched Period* is dominant. [ & Haime.
  - 2. *Parasmilia centralis* (Mantell).

B. Peduncle or lowest part of Trochoid shape-stage with granules; i. e. *costal-stage VII.* is attained.

- I. Granules are the costal ornament even in the most distal parts of the corallum, though the granules may be massed together; i. e. *costal-stage IX.* is not attained.
  - a. In the parts of the corallum with granular costæ the granules are mostly individually separate and the costæ low and broad; i. e. *costal-stage VII.* is dominant.
    - 3. *Parasmilia fittoni* Edwards & [Haime.
  - b. In the parts of the corallum with granular costæ, the granules mostly are more or less massed and the costæ comparatively high; i. e. *costal-stage VIII.* is dominant.
    - 4. *Parasmilia granulata* Duncan.

II. At the distal end of the corallum the costæ are thin, high and sharp and without granules; i. e. *costal-stage IX.* is attained.

- a. Granules vanish from costæ only for short periods, before a rejuvenescence; i. e. *costal-stage IX.* is hardly attained.
  - 1. No intercostal dissepiments; a long katagenesis between *costal-stages VI.* and *VII.*
    - 5. *Parasmilia gravesi* Edwards & [Haime.
  - 2. Numerous intercostal dissepiments; *costal-stage VII.* immediately follows *costal-stage VI.*
    - 6. *Parasmilia mantelli* Edwards & [Haime.
- b. Granules vanish from costæ over long stretches of the corallum; i. e. *costal-stage IX.* is easily attained.
  - 1. Costæ on the peduncle on the whole are low and inconspicuous with many granules; i. e. *costal-stage VII.* is well developed. Corallum is large, diameter in cylindrical shape-stage 15-20 mm.
    - 7. *Parasmilia cylindrica* Edwards & [Haime.
  - 2. Costæ on the peduncle on the whole are high and granules not scattered; i. e. *costal-stage VII.* is poorly developed. Corallum is small, diameter in cylindrical shape-stage 6-8 mm.
    - 8. *Parasmilia monilis* Duncan.

March 16, 1909.

FREDERICK GILLET, Esq., Vice-President, in the Chair.

The Secretary read the following report on the additions made to the Society's Menagerie during the month of February 1909 :—

The number of registered additions to the Society's Menagerie during the month of February last was 92. Of these, 50 were acquired by presentation, 2 by purchase, 28 were received on deposit, 2 in part exchange, and 10 were born in the Gardens.

The number of departures during the same period, by death and removals, was 134.

Amongst the additions special attention may be directed to :—

One Common Tapir (*Tapirus americanus*) ♂, from South America, and one Malayan Tapir (*Tapirus indicus*) ♀, from Malacca, received in part exchange on February 2nd.

One American Bison (*Bison americanus*) ♀, born in the Menagerie on February 27th.

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The Secretary exhibited, on behalf of Mr. E. C. Chubb, F.Z.S., the skins and skulls of two fœtal lions which had been presented to the Rhodesia Museum, Bulawayo, by Mr. A. Giese. They had been taken from a lioness which Mr. Giese shot last November at Deka, about 50 miles south of the Victoria Falls.

These fœtuses showed very little pattern compared to that of newly born cubs; the black markings in each example of the former consisting only of a fairly well-defined median dorsal line, a mottling on the head, some distinct spots on the outer sides of the limbs, and a suspicion of rings on the tip of the tail.

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The Secretary exhibited a photograph of a young American Tapir, and called attention to the remarkable resemblance between that and the young Malayan Tapir, a photograph of which was reproduced in the Society's 'Proceedings,' 1908, p. 786. The longitudinal light stripes on the flanks of the body, the spots on the legs, and the white tips to the ears were present in both.

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The Secretary called attention to an interesting paper by C. Onelli in the 'Revista del Jardin Zoologico de Buenos Aires,' 1908, p. 207, in which the author described a general correspondence between the number of vertebrae and the number of stripes or rows of spots in many mammals.

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The Secretary exhibited a photograph of a small herd of Mountain Zebras (*Equus zebra*) in the possession of a dealer at Port Elizabeth, South Africa.

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